

Waterfowl Hunter Satisfaction Think Tank

Understanding the relationship between waterfowl hunting regulations and hunter satisfaction/participation, with recommendations for improvements to agency management and conservation programs.

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Executive Summary

In 2002, the Wildlife Management Institute (WMI) received a federal aid grant to develop an overall framework and specific recommendations on:

1. How to gain a more thorough and rigorous understanding of the relationship between waterfowl hunting regulations and hunter satisfaction, recruitment, retention, and involvement in habitat conservation; and
2. How to systematically incorporate this understanding into management and conservation programs.

The intent of this project was to capture all of the previous work done in this area, focus the best thinking on the issues, define future direction, and recommend research needs.

The project had four components:

1. Compile previous research and literature;
2. Assemble a “Think Tank” of technical and administrative representatives from Flyway Councils and U.S. Fish and Wildlife Service (USFWS), and experts in the fields of hunter recruitment/retention and human dimensions research;
3. Through two meetings of the Think Tank, create a sense of direction and internal agreement; and
4. Develop specific recommendations for improving/enhancing management programs.

As befitting a “Think Tank,” the work of the group was characterized by sharing of voluminous background materials and lively, wide-ranging discussions during the workshops, on conference calls, and via e-mail.

This report includes a series of chapters authored by individual Think Tank members followed by “Conclusions” and “Recommended Actions” sections.

The chapters are the foundation on which the conclusions are based, and while there is not unanimous agreement among Think Tank members on all points made in each of these chapters, there is acceptance by the majority of members on the report content and recommendations. The chapters have been reviewed internally by the Think Tank members, but have not been published elsewhere or peer reviewed in a formal sense.

The “Conclusions” and “Recommended Actions” sections are an attempt by the Think Tank to condense and synthesize findings and provides concise information and guidance for waterfowl managers.

It is challenging to make generalizations about the relationships between regulations, satisfaction, participation and involvement in conservation. The following conclusions and recommended actions are based on the literature, and on the discussions within the Think

Tank. These are not comprehensive, but represent the issues and suggested courses of action that the Think Tank believed would be most useful for managers.

1. Research suggests that regulations can have an effect on satisfaction and short-term hunting participation when there are dramatic changes such as a major reduction in opportunity or increased costs. However, it is difficult to predict accurately either the specific regulatory conditions affecting participation or the magnitude of the effect(s). Moderate changes in such things as season length or bag limits have not been shown to produce significant effects on recruitment and retention. Regulations may introduce new constraints to low-commitment hunters serving as the impetus for the gradual withdrawal from the sport.
2. The “preferences” of hunters for regulation options are dynamic and may:
 - Change over time;
 - Be influenced by expectations or perceptions about the resource condition; and/or
 - Be different for different subgroups of hunters (based on location, specialization, stage of development as a hunter, etc.) For example, specialists may prefer restrictive regulations so they can "capture" a larger share of the resource or hunting opportunity.
3. Satisfaction with a season may be affected to some extent by regulations, but satisfaction is only one of many considerations in hunters’ participatory decisions. Thus, participation (retention and recruitment) over the long-term is likely to be influenced to a relatively small degree by regulations. Rather, long-term participation is primarily influenced by broad-based changes in an individuals’ social and cultural values, many of which are beyond the natural resource manager’s control
4. Use of behaviors such as participation or license buying as an indicator of retention can be challenging for a number of reasons. First, not all “active” hunters participate in waterfowl hunting every year. Recent research indicates that there is a much larger pool of “active” hunters than previously suspected. In any given year, only a portion of this pool of hunters may actually hunt. As a result, the composition of hunters in any given year may be very different from the previous year. Beyond that, however, it is likely that a large percentage of hunters who eventually desert the sport do not make a conscious decision to quit. Termination is often marked by prolonged inactivity with the intention of one day returning to the sport.
5. Without more systematically gathered and appropriate information to guide regulatory decisions, changes to regulations (or other management actions) may not have the intended consequences in terms of waterfowl hunter satisfaction, participation or involvement in conservation. Moreover, we don’t have the information (particularly at the national level) to predict with reliability what the consequences might be and no monitoring tools in place that would allow us to discern changes after the fact.

Although some human dimensions information can be gathered quickly, relatively inexpensively, and put to use immediately, there are needs that likely can only be met through long- term efforts requiring significant financial commitments and coordination from the waterfowl-management community.

6. The waterfowl-management community remains interested in framing objectives for the AHM process that relate more directly to hunter satisfaction and participation rather than to the size of the harvest. We continue to see no theoretical problem in pursuing objectives defined in these terms, but clearly there are major challenges in application. Considerable foundational research would be needed to identify the appropriate hunter-related performance metrics, how those parameters would be measured, and how they might be influenced by changes in hunting regulations. Given these difficulties, it may be more appropriate to pursue hunter-related objectives indirectly through the specification of regulatory alternatives and possible constraints on their use. Moreover, the most productive nexus for addressing hunter satisfaction and participation issues in the regulatory process may be at the State level, rather than at the federal domain of the AHM process.
7. If increased participation (recruitment and retention) of hunters over both the short and long term is important to waterfowl managers, then they must look at a broad array of factors that affect participation rather than regulations exclusively.
8. States use a diversity of methods for involving stakeholders in the decision-making process and these methods need to be documented and evaluated to determine how the processes could be made more effective. There is reason to question the reliability of input provided by highly specialized and involved hunters that participate through advisory committees and other processes, and how accurately it represents the hunters of a state or region. Their input may actually be a valid assessment even though survey results differ, because they are more experienced and informed and better able to evaluate choices of season opening dates, etc. Alternatively, their own preferences may not satisfy the statewide population at all, in which case the public input system is not representative and likely to continue to fail to optimize hunter satisfaction with waterfowl regulations.
9. There is evidence demonstrating that the influence of hunting participation on hunter stewardship and ethics is not universal among hunters and/or is not universally expressed in all issues. Hunting may contribute to the development of stewardship and related behaviors among the hunting community, but it does not appear to guarantee that development nor is it the only means of influencing such development. There is a growing recognition among waterfowl managers that human-dimensions information may be just as important to developing successful hunting regulations and other management programs as is biological information. However, incorporating social information into management processes in a rigorous, scientific fashion represents a formidable challenge. There are three key reasons for this:

- a) The complexity of the relationships between hunting regulations and the outcomes managers seek, as well as a lack of consensus among managers about preferred outcomes and their priorities;
- b) A limited understanding of human-dimensions science among waterfowl managers; and
- c) Limited funding for monitoring and research of human-dimension issues of interest.

Given these hurdles, we believe the waterfowl-management community must engage in a more systematic discussion of human-dimension needs and their priorities relative to other management activities. This report serves as a foundation for that discussion.

Recommended Actions

As previously explained, the relationship between regulations, satisfaction, participation and involvement in conservation is very complex. Considerable effort by waterfowl managers will be required to understand and incorporate this relationship in future regulations.

Foundational research is needed to identify the appropriate hunter-related performance metrics, how those parameters would be measured, and how they might be influenced by changes in hunting regulations. In addition, monitoring tools need to be developed and implemented that would allow us to discern changes after the fact. Most of these needs can only be met through long- term efforts requiring significant financial commitments and coordination from the waterfowl-management community.

The most productive level for addressing hunter satisfaction and participation issues in the regulatory process will likely be at the State level, rather than at the federal domain of the AHM process. However, to obtain a full picture of the complex interacting factors, research and monitoring will be required at both levels. This will require waterfowl managers to look at a broad array of factors that affect participation and become much more familiar with human dimensions, rather than exclusively understanding the regulations process.

In addition, an evaluation of the public input process for developing regulations at both the federal and state level is needed to ascertain the reliability of input provided by highly specialized and involved hunters that participate through advisory committees and other processes, and how accurately it represents the hunters of a state or region in optimizing hunter satisfaction with waterfowl regulations.

Introduction

Waterfowl managers, hunters, and agency administrators consider hunting regulations, as they strive towards achieving a variety of outcomes or goals. The primary goal being perpetuating waterfowl resources at sustainable levels that assure sustainable populations and future hunting opportunities. Waterfowl managers desire hunting regulations that:

- Are acceptable to diverse hunter interests and survive the decision-making process;
- Sustain participation of waterfowl hunters over both the short- and long-term; and
- Contribute directly or indirectly to conservation of waterfowl and their habitats.

For years, managers have recognized that the relationships between these outcomes are complex and in many ways poorly understood (Johnson & Case, 2000). Human dimensions studies have suggested that progress towards goals regarding hunter participation and satisfaction may not be substantially achieved simply through regulations that provide for the maximum allowable harvest (Enck et al., 1993; Ringelman 1997).

A survey of Flyway Technical Group and Council representatives (AHM Working Group Report 2000) indicated that most Flyway representatives believed that information about hunters was an important component of hunting regulations development. Less than half the states surveyed, however, were systematically collecting this information. Although hunter participation and satisfaction have been long-term concerns of the waterfowl management community, it was unclear how measures of hunter satisfaction would be incorporated into the Adaptive Harvest Management (AHM) process currently used to adjust hunting regulations. To do so, managers would need more information about the social and aesthetic aspects of the hunting experience.

At a Joint Flyway Council meeting in July 2000, a subcommittee of the AHM Working Group recommended that a “Think Tank” of experts be assembled to frame the issues and outline options for addressing them. This recommendation was re-confirmed by the AHM Working Group at the April 2001 meeting. This project was developed in direct response to this stated need of the AHM Working Group.

Project Purpose

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Project Components

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1. Compile previous research and literature;
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3. Through two meetings of the Think Tank, create a sense of direction and internal agreement; and
4. Develop specific recommendations for improving/enhancing management programs.

Think Tank Process

The WMI contracted with D.J. Case & Associates for facilitation and management of this project. This report was prepared by David Case on behalf of the Think Tank.

The 15-member Think Tank (Appendix A) was formed in March 2003. Following is a summary of the Think Tank process and timeline:

- The first Think Tank workshop was held in April 2003 in Jackson, MS.
- The human dimensions specialists from the Think Tank met in October 2003 in Mishawaka, IN.
- The human dimensions specialists developed a series of papers following the October meeting. These papers were edited into a “framework” that was distributed to the entire Think Tank.
- A second Think Tank workshop was held in December 2003 in Chicago, IL.
- Think Tank member Jody Enck presented a summary of Think Tank efforts along with preliminary conclusions and recommendations at the AHM Conference in January 2004.
- In February and March 2004, this report was compiled and various drafts reviewed by Think Tank members.

As befitting a “Think Tank,” the work of the group was characterized by sharing of voluminous background materials and lively, wide-ranging discussions during the workshops, on conference calls, and via e-mail.

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Chapter 1: Hunter Satisfaction and Harvest

Jody Enck

The greatest sustained attempt at using an adaptive approach to wildlife management has been with adaptive harvest management (AHM) of waterfowl (e.g., Johnson et al., 1993; Williams & Johnson, 1995; Johnson et al., 1997; Williams, 1997; Johnson & Case, 2000). Managing adaptively entails a *process for decision-making* (e.g., Lancia et al., 1996; Riley et al., 2003). Essential components of this process include: analyzing the management situation to determine “the problem” to be addressed, defining management goals and objectives, developing a model of the management system to reflect factors that influence achievement of objectives, identifying and implementing alternative management actions or policies for meeting objectives, monitoring management outcomes, and adjusting decisions based on this process of “learning by doing” (Walters, 1986).

Situation assessment involves identifying management problems to be solved in terms of goals and objectives, and describing the management context within which problems might be addressed. In practice, adaptive management typically has meant describing management problems in terms of needed changes in (i.e., management of) the *state* of system components (i.e., population or habitat characteristics) and/or proportional or temporal *rates* associated with ecological processes (e.g., predation rate, birth rate, harvest rate) that drive interrelationships among system components (Walters, 1986; Johnson et al., 1993; Lancia et al., 1996). Management of these states and processes is needed to sustain or optimize ecological function. The focus of adaptive management has been to alter the processes that affect the level of states in the system (Walters, 1986). Implicit in selection of resource states or processes to manage is the assumption that those are important (or should be important) to society (e.g., Johnson et al., 1993; Johnson & Case, 2000).

With the case of AHM, resource states and processes that are assumed to be important to society and which have been incorporated into objective functions include duck population status and harvest rate. These have been selected based on the assumption that size of harvest by individual hunters directly affects satisfaction for those hunters. Although harvest likely is an important factor affecting satisfaction for many waterfowl hunters, other factors are undoubtedly as important or more important. Identification and incorporation of these underlying factors into the objective functions of AHM should theoretically improve the selection of alternative management actions that influence satisfaction and improve the predictability of those alternatives on harvest behavior.

The nature and range of these underlying factors and their role in predicting hunter satisfaction and continued participation can be inferred from a review of the literature on hunting-related satisfaction. Some of the first studies of hunter satisfaction from the 1970s and 1980s concentrated on a single, harvest-related component pertaining to a particular hunting trip (e.g., number of game animals seen or harvested) (Crissey, 1971; Langenau et al., 1981). Others focused on nonharvest components related to crowding or encounters with strangers (Heberlein et al., 1982). Some of these early studies were conducted from the perspective of an entire hunting season, rather than a single trip afield. However, those studies generally were limited to an examination of harvest-related satisfactions (e.g.,

Stankey et al., 1973). Most of these studies seemed to be based on the hypothesis that evaluations of satisfaction with a single component would influence likelihood to participate.

Starting in the mid-1970s, researchers developed the concept of multiple satisfactions. This concept recognized that hunters seek and derive numerous types of satisfactions relating to their experiences during a hunting season (Potter, et al. 1973; Hendee, 1974; Decker et al., 1980). The multiple satisfactions concept expanded on the theoretical relationship between hunt quality and likelihood of going hunting again in the future.

Langenau and Peyton (1982) added a temporal dimension by examining multiple satisfactions that occurred during three stages of a single hunting trip: (1) "planning and preparation" during which the hunter "gets ready" for a hunting trip, (2) "field experience" which includes the time spent hunting afield, and (3) "recollection" which reinforces and adds to satisfactions gained during the other stages. This research provided a first recognition of hunter satisfactions that occurred outside of the regulatory framework of wildlife agencies.

Enck and Decker (1991, 1994) expanded on that notion, and examined the types of satisfactions that were derived from experiences that occurred throughout the year. They examined satisfaction components associated with temporal (preseason, during season, and postseason) and motivational (affiliative, achievement, and appreciative) dimensions. Examination of satisfaction components arranged in a 9-cell matrix with three temporal and three motivational dimensions revealed that postseason/preseason experiences in consecutive years overlapped, producing year-round hunter satisfactions.

Vaske et al. (1986) grouped satisfaction components into three categories they named nature/sport, wildlife, and human interaction. They found that nature/sport variables explained more of the variance in satisfaction for waterfowl hunters than either wildlife or human interaction variables. Further, they found no support for the hypothesis that greater harvest leads to greater satisfaction for individual hunters. Hammitt et al. (1990) reported similar findings for deer hunters, concluding that different kinds of satisfaction components influenced hunters' assessment of the quality of the hunting experience vs. quality of the hunt. For instance, environmental (i.e., weather conditions and being outdoors) and social (i.e., crowding and hunting behavior) factors were the best predictors of satisfaction with the hunting experience. Deer population variables (i.e., number of deer seen, number of deer bagged) were the best determinants of a quality deer hunt (Hammitt et al., 1990).

Hammitt et al. (1990) also reported that hunters' estimates of deer herd size, based on the amount of deer sign seen or numbers of deer encountered, influence their harvest behavior. The association between hunters' recent experiences and future behaviors is consistent with Molnar and Smith's (1982) finding that level of willingness to participate in an action indicates the degree to which a person believes the particular action is a means of achieving desired outcomes. Hunters use game population characteristics and related variables to estimate the size of the game population. Based on this estimate, they decide whether harvesting additional or fewer animals this year will likely affect various

satisfaction/dissatisfaction components next year (i.e., seeing game sign, getting a chance to shoot enough game to make it worth their while). Because environmental and social variables are less directly, or not at all, related to hunters' estimates of the game population, they do not provide much insight about hunters' harvest behavior.

More recently, and consistent with the notion of the multiple satisfactions concept, Riley et al. (2002) and Riley et al. (2003) supported the notion that adaptive, experimental management of wildlife has the potential to enhance management decision-making. The greatest benefit can result if research is directed toward improving decision making by integrating biological and human dimensions information to attain objectives of importance to society. They further suggested that good management decision-making needed to take into account explicitly that different stakeholders recognize and place importance on different objective functions—which can reflect different components of satisfaction—and that when these objectives are met, they contribute to the goal of having satisfied waterfowl hunters.

Whereas management goals related to the management problem are relatively broad statements about the purpose of management, objective functions are more specific statements about what management is intended to achieve. Objectives often are stated as measurable outcomes against which the success or performance of management actions can be evaluated (e.g., Walters, 1986). Identification of objective functions depends greatly on the starting premises associated with the management situation. For example, a starting premise of AHM is that an optimal set of management actions can be found to achieve a desired ecosystem response (Johnson et al., 1993; Lancia et al., 1996).

An alternative starting point is to consider that human values provide the lens through which different stakeholders interpret and evaluate various recognized outcomes of management (Riley et al., 2002). That is, different stakeholders may value – for quite different reasons – a change in wildlife populations or in ecological processes. In this case, the ecological response may be only a means to several different fundamental ends desired by various stakeholder groups, or even the same stakeholder group. For example, duck hunters for whom harvest is a desired outcome may have very different reasons for wanting to harvest waterfowl. If hunters associate more than one fundamental end with waterfowl harvest (e.g., for food, to achieve status, etc.), more work needs to be done to discern the important fundamental ends associated with harvest because harvest is only a *means* for achieving other *ends*. A necessary starting point then is to ascertain what objective functions should be the focus of management, and how to develop models for selecting management actions that will achieve those objectives.

Insights about the fundamental ends that hunters may associate with waterfowl harvest can be gained by examining two related paradoxes from the satisfactions literature. First, increasing harvest (or harvest opportunity) does not always increase satisfaction, and can decrease satisfaction. Second, the same amount of harvest (or harvest opportunity) can both satisfy and dissatisfy simultaneously, although of course, for very different reasons. Hunters evaluate whether a particular amount of experienced or potential harvest is “good”

or “bad” based on basic beliefs and values about the fundamental ends they associate with waterfowl hunting.

Findings in the literature support the hypothesis that hunters’ overall evaluation of satisfaction is related to levels of both positive and negative fundamental ends they associate with harvest. Does/will a particular amount of harvest increase or decrease the “good” things about waterfowl hunting that are *very important* to hunters? If the levels of these positive fundamental ends are above a minimum desired level, hunters should be satisfied. If the levels are below a minimum desired level, hunters should be dissatisfied. Does/will a particular amount of harvest increase or decrease the “bad” things about which hunters are *very concerned*? If the levels of these negative fundamental ends are below a maximum tolerable level, hunters should be satisfied. If the levels are above a maximum tolerable level, hunters should be dissatisfied.

Small harvests (or harvest opportunity) may decrease satisfaction if hunters associate that harvest with lower-than-desired levels of positive fundamental ends, such as “sufficiency of harvest” or “hunting expertise.” For example, 50% of New York duck hunters in the early 1990s apparently believed they would not experience a minimum desired level of “sufficiency” with a bag limit of <three ducks/day (Enck & Decker, 1990). In the late 1990s, Ringelman (1997) found that 40% of duck hunters nationally would quit hunting if the bag limit was just one duck/day, supporting the hypothesis that a harvest of 1 duck was below their desired level of harvest sufficiency. Further, harvesting too few of a particularly challenging species may decrease satisfaction for highly committed waterfowl hunters who hunt consistently year-to-year and who place great importance on demonstrating “hunting expertise” (Enck & Decker, 1990).

Conversely, small harvests (or harvest opportunity) may increase satisfaction if hunters associate lower harvests with desired levels of positive fundamental ends, like “trophy value,” being a “conservationist,” or “fairness” among hunters. In the 1950s, hunters in the Mississippi Flyway who harvested just one to two geese felt “repaid” for their effort and indicated that higher harvest could detract from the quality of their hunt, diminish the trophy value of geese, and lead to overall dissatisfaction (Schoenfeld & Hine, 1958). More recently, several studies have found that waterfowl hunters pass-up shots at certain duck species or female ducks as a way of achieving a desired level of being a “conservationist” (e.g., Enck & Decker, 1991; Miller, 2000). Support for management actions that reduce harvest by individual hunters also have been related to the notion of increasing the level of “fairness” among hunters (e.g., Glass & More, 1992).

Small harvests also may increase satisfaction if hunters believe lower harvests decrease the levels of negative impacts, such as “excessiveness of harvest” (i.e., being a game hog) or degree of being unethical. For example, Ringelman (1997) found that hunters preferred a bag limit of <5.6 ducks/day on average, perhaps because higher harvest opportunity would have exceeded a tolerable level of “excessiveness.” Miller (2000) surmised that hunters may criticize large bag limits for snow geese as being intolerably excessive. Findings reported by Glass and More (1992) and Kuentzel and Heberlein (1998) suggest that hunters might support lower bag limits (i.e., lower harvest opportunity) as a way of reducing the

practice of sky-busting at geese, which even sky-busters themselves said contributed to intolerable levels of being unethical.

These examples of paradoxical relationships between harvest and overall satisfaction highlight the need for understanding the positive and negative fundamental ends that hunters associate with waterfowl harvest. Identifying these ends and incorporating them into the objective functions of management should improve management decision-making, compared to focusing on harvest per se. Perhaps future harvest could be predicted with greater precision if these were parameterized as part of the AHM model.

The ideas presented thus far for incorporating the concept of hunter satisfaction into the objective functions of AHM have focused on individual-level measures of satisfaction that then can be aggregated in the form of some average level for a population of waterfowl hunters. An alternative idea involves the concept of social utility (Loomis 1993). It suggests that we attempt to determine the utility of a particular service based on peoples' willingness to pay for it. Key to applying this concept is estimation of a demand curve showing the relationship between (for example) the number of days in the season and the resulting aggregate utility (measured as total willingness to pay) for hunters. A demand curve would reveal how the utility of each extra day hunting diminishes or increases the cumulative value as more days are added to the season.

The social utility measure is actually one of the few, if not the only approach that has been used in estimating the summed effect of a service. For example, in using the overall satisfaction approach for assessing utility to hunters, it is assumed that if more days hunting is important to a person, their overall satisfaction rating (given at the end of a season) will be increased if more days are offered. The social utility approach suggests that the utility gained is the sum of utility received in all individual trips taken (measured as the amount you would have been willing to pay for each trip taken). Critics have argued that the willingness to pay metric is subject to many biases and may be unreliable, however, the simplicity, predictive ability and comparability of study results have made this a popular approach.

Chapter 2: Effects of Regulations on Hunter Participation and Satisfaction

Mike Manfredo

Discussions and deliberations in the annual process of formulating waterfowl hunting regulations often assume that:

1. Regulations can have a significant affect on hunter's satisfaction with their hunting experiences;
2. Hunter satisfaction will have a direct affect on hunter participation, hunter recruitment and hunter retention; and
3. Regulations will have a direct affect on hunter participation, recruitment and retention.

Are these assumptions valid? Unfortunately, research on this topic is not definitive. A limited number of studies have examined the topic and those that have been conducted typically have a short time frame and are descriptive (as opposed to longitudinal studies that have evaluated regulatory change). However, research that is available would lead one to the conclusion that the strength of these relationships depends on the specific variables and the context under consideration. It would depend, for example, on the participation behavior(s) of interest (e.g., buying a license, participation in the season, number of trips taken), the type of regulation being considered (e.g., license fee, length of season, bag limit, complexity of regulation), the extent of change associated with a regulatory change, (e.g., percent decline in season length, percent increase in license costs) and the length of time under consideration (one season, one trip, several seasons). Given these contingencies and the limitations of research on this topic, the approach taken here was to present available findings in the context of theoretical frameworks that helped guide conclusions about the relationships.

Clarifying the Concepts of Satisfaction and Participation

As a prelude to introducing these findings, the concepts of satisfaction and participation are clarified. The notion of hunter satisfaction was one of the first concepts to be explored in the human dimensions of wildlife literature. Early research attempted to identify hunting's multiple satisfactions (Hendee, 1974). For the most case, these satisfactions were simply aspects of hunting that were evaluated positively by the participant. As this line of inquiry became more sophisticated, satisfaction was tied to the concept of human motivation as researchers attempted to understand why hunters participate (e.g., Driver and Brown, 1975). Satisfactions, in this case, were fulfilled motivations and included things such as achievement, socialization, stress release, status seeking, etc. This approach served as the basis for defining types of recreation experiences and led to development of the Recreation Opportunity Spectrum planning used by the U.S. Forest Service and Bureau of Land Management and to notions of experience based management advocated for use in management for wildlife viewing (Manfredo, 2002).

A second, more common use of the satisfaction concept is as an *overall evaluation* (Manfredo, Vaske, & Decker, 1995). For example, hunters might evaluate a single trip, the entire season, or aspects of the trip (e.g., regulations, weather, game seen) as satisfying or dissatisfying. That will be the usage we explore here. This use of the term satisfaction is, in fact, addressed in the well developed concepts of attitude-behavior theory. This theory, which guides our discussion of hunter's decision to participate in hunting, describes the relationship between attitudes (evaluations) and behavior.

Participation is a variable that also demands some clarification. Certainly there are many potential participation variables of interest. This might include, for example license buying behavior, individual trip behavior, whether one participates in the season or not, one's sustained participation pattern, one's future intention to participate, etc. Because different factors affect participation based on the time frame being considered, separate discussion is given here to "short term" participation decisions versus "long term" participation patterns. In the first case, we examine individual level factors that affect the decisions of existing hunters to buy a license and participate in hunting for a given season. In the case of long term participation, we will describe factors that affect broad based, inter-generational participation trends and the likelihood that regulations will affect those trends.

Short Term Hunting Participation

Prior literature would suggest that increased or decreased regulatory restriction can have a dramatic effect on hunter participation. The most direct evidence is provided through studies that evaluate the actual implementation of newly restrictive regulations. For example, research by Fix, Teel, and Sikorowski (2001) examined big game hunting participation over time in several western states. Findings show that license fee increases generally reduced hunter participation the year of implementation, however it produced only a short term decline which is followed by the resumption of the longer term trend. Research by Barro and Manfredo (1996) examined a case where a dramatic reduction in the length of Colorado's deer hunting season (40-70%) resulted in a one-third reduction in license buying as well as reduced intention to participate in the future. Miller (2000) reported that when snow geese hunting regulations were made extremely liberal in Illinois (no bag limits, unplugged shotguns, electronic calls, hunting ½ hour after sunset) participation increased more than 500% in a two-year period.

Other research has explored the effects of regulations on participation by examining factors that explain self-reports of participation patterns. For example Miller and Vaske (2003) asked a sample of Illinois hunters to indicate whether their hunting effort increased, stayed the same or decreased over the prior five-year period. Personal and situational constraints were strong predictors of this variable and in particular, the researchers point out that "no land available for hunting," "not enough game" and "too many regulations" were important predictors. Similarly, based on prior participation and intention to hunt in the future, Enck et al. (1993) identified New York waterfowl hunters as "consistent" "sporadic" or "dissociations." Prominent reasons for dissociation from hunting (hunted previously but intend not to hunt in next three years) included confusing regulations and huntable populations.

In terms of constraints of hunting, the more frequent finding in research on non-participation indicates that former participants report having “no time” to engage in the activity. For example, 51% of ex-hunters in Alabama cited that as the reason for not hunting (Mehmood, Zhang, & Armstrong, 2003). This reason, of course, reveals a more basic process by which hunting becomes less desirable than other activities within one’s decision set. Decker, Brown and Siemer (2001) suggest it is related to the lack of family support, social reinforcement and apprenticeship experiences.

Other research asks hunters to indicate how they would behave under hypothetical conditions of change. For example, Pierce, Ringelman, Szmczak and Manfredo (1996) asked Colorado waterfowl hunters the likelihood that they would hunt under conditions of different bag limits and conditions of different season length. Their findings suggest that the probability that active hunters would participate increases as daily bag limits increased. The highest levels are reached at about four or more ducks per day. Furthermore, the probability of participation increase as season length increases up to about 40 days or more. Of course the limitation of these types of studies is that the relationship to actual behavior is unknown.

It is clear that hunting regulations can and have affected hunter participation. It is difficult, however, to predict accurately what specific regulatory conditions affect participation and how the effects occur. Fulton and Manfredo (In Press) suggest that the relationship between regulatory restriction and participation is not linear, rather there are certain regulatory thresholds beyond which participation reacts abruptly. In the next section, a hunter decision model is used to describe how regulatory restriction affects hunter participation.

The Effects of Regulations in the Context of A Model of Participation Choice

The effects of regulations on hunter satisfaction and short term hunting participation is best conceptualized in the attitude-behavior model displayed in Figure 1. This model of participation is based on attitude behavior theory introduced by Fishbein and Ajzen (1975; Ajzen, 1991), which is a widely applied model that predominates attitudinal research in the human dimensions of natural resources (Fishbein & Manfredo, 1992; Manfredo, Teel, & Bright, In Press). This model suggests that a specific behavior or class of behaviors is influenced by three primary variables: attitude toward the behavior(s), normative influences and perceived behavioral control (Figure 1). One’s attitude toward a behavior is simply an evaluation about performing it, e.g., one has a positive, neutral or negative evaluation toward performing buying a license for the season. This evaluation is formed within the individual as the result of deliberations about the outcomes associated with performing the behavior. There are two qualities associated with an outcome, the likelihood of occurrence and the desirability of the outcome. For example, a person might believe that if they go hunting during the season, it is highly likely that they will harvest waterfowl and that harvesting waterfowl is a highly desirable outcome. This would contribute toward a very positive attitude toward participation. However, the person may also believe that hunting will require them to take considerable time from their family

which is judged to be a very undesirable outcome and which would contribute toward a negative evaluation. In the attitude formation process, the person deliberates on all outcomes that come to mind regarding the decision, weighing positives and negatives to arrive at an overall evaluation.

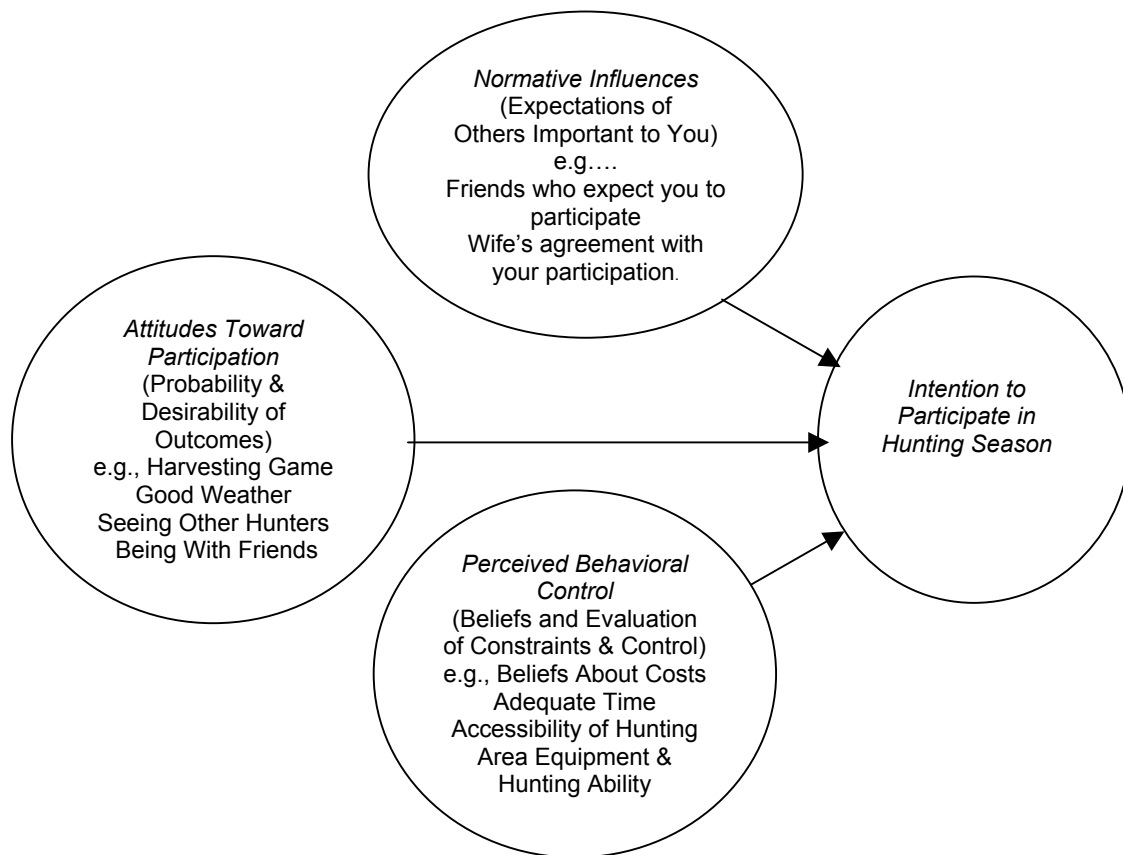


Figure 1. Model of a Waterfowl Hunter's Decision To Participate in a Given Season.

Two other variables enter the behavioral decision in addition to one's attitude. One accounts for normative influences, which refers to the influence that others have upon your decision. For example, a person may have a friend or group of friends with whom they hunt regularly. These friends may have a strong expectation for this person to participate in waterfowl hunting. The person's belief about their friends' expectations could have a strong influence on the decision to participate (even though their attitude toward participation may be weak).

The other variable is referred to as perceived behavioral control, which deals with one's belief about their ability to engage in the behavior. Some may believe that they would like to participate but that the barriers are simply too great. For example, while a person may have a positive attitude toward participation, they may believe that there is not available location to hunt, may know no companions with who to participate, may perceive the costs of participation to be too high, or may believe regulations are too complex. If that were the case, it is unlikely the person would participate.

Given this model, how would regulations or prior satisfaction affect the decision to participate in the future? The simple answer is that they will only affect future participation if they become salient enough to enter the deliberative process described above. That might happen by introducing new beliefs about participation into the decision process (e.g., does not leave enough time for me to hunt, would make it difficult for me to identify legal ducks, would cost more than I can afford) or by altering the likelihood of beliefs that might be considered without the regulatory change (e.g., decrease the likelihood that a person will be able to see sufficient waterfowl, increases the likelihood that a person will see many other hunters).

Within this context, prior research suggests that regulations will affect hunter participation in two primary ways (Shown as arrows in Figure 2). First, Heberlein and Kuentzel (2002) suggest that knowledge about regulations operate by affecting a person's belief about the likelihood of harvest. Unless the attitude is already quite positive toward participation, the "new" information about regulations could weaken one's attitude leading to the decision to decline participation. Interestingly, the same regulation may make another person believe that fewer people will hunt and that will have a positive effect on their harvest potential. This would actually increase their positive attitude. The effect that a regulation will have is totally dependent upon the conclusions hunters draw about the effects of the regulatory change and the prior beliefs held by the individual.

Second, regulatory changes can affect one's perceived ability to participate. Several studies have noted that perceptions of constraints are important determinants of participation. Enck, et al.(1993) for example, found regulatory complexity is a barrier to waterfowl hunters in New York. Barro and Manfredo (1996) found that when deer seasons were reduced to three days in Colorado, hunters believed it left too little time to hunt. If the perceptions of constraints rise to a sufficient level, it tips the behavioral decision against participation.

Several other conclusions can be drawn from this model. First, not all people value the same outcomes, hence, there will be differences in how people are affected by increasing regulatory restriction. As noted above, some may value highly restrictive regulations because they believe it would reduce crowding, adding strength to their positive attitude. Second, those "on the fence" with only slightly positive attitudes toward participation, with significant constraints or without strong normative support will certainly be the ones most influenced by increased regulatory restriction. These people are more likely to decline participation as more restrictive regulations are introduced (or increase participation as more liberal regulations are introduced). Third, it is certainly possible for regulatory changes to have elements that are believed by hunters to result in positive outcomes as well as negative elements. Furthermore, unless regulations are extremely prohibitive and enduring, any negative affects are quite likely reversible in the short term as the "demand pool" of prior hunters likely reconsider participation on an annual basis.

In summary, regulations will have an affect on hunters' decisions if they believe it will affect the outcomes of participation (e.g., the increased likelihood of positive outcomes

from new regulations increases likelihood of participation, decreased likelihood of positive outcomes leads to a more negative attitude). Prior research indicates that regulations affect

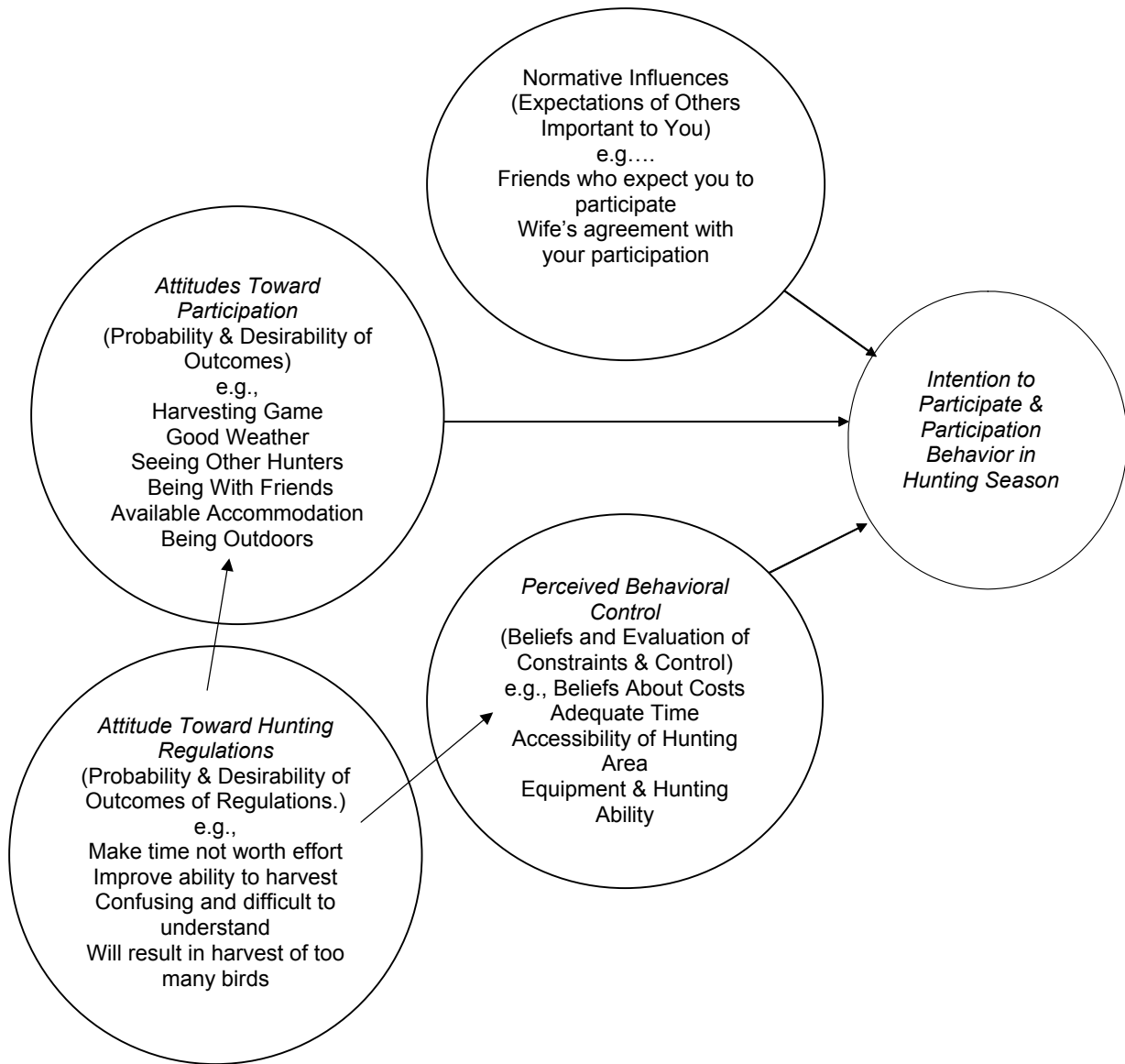


Figure 2. Model Showing Effect of Regulations on Hunter's Decision To Participate in a Given Season.

participation through their impact on beliefs about harvest and the extent to which they provide constraints or barriers to participation.

From this discussion it should be clear that a key to predicting the impact of regulations is an understanding of the hunters' beliefs about the outcomes of regulations. And while hunters beliefs may disagree with beliefs held by biologists or managers, it is important to realize that to understand and predict hunter behavior it is critical to determine what *hunters* believe to be true. If the veracity of hunters' beliefs is questionable, that points to an opportunity for use of information to sway hunter behavior.

Regulations and Trip Satisfaction

Research has shown a relationship between regulations and satisfaction with a given hunting season (Fulton & Manfredo, In Press; Heberlein & Kuentzel, 2002; McCullough & Carmen, 1982). Findings show, however, that the effect of prior satisfaction is usually quite minimal and that the factor explaining the greatest amount of variance in satisfaction is harvest (e.g., Gigliotti, 2000; Hammitt et al., 1990; Heberlein & Kuentzel, 2002; McCullough & Carmen, 1982; Miller & Graefe, 2001; Vaske et al., 1986). And while satisfaction can be quite useful in gauging hunters' evaluation of a season, it is quite limited for predicting effects on participation.

Perhaps the most significant limitation of season satisfaction measures is that it only reveals evaluative judgments of those who chose to participate, i.e., those who do not participate are not included in these assessments. Because those people are excluded from the sample, it is possible that the effects of regulations are underestimated and, due to the omission of more negative evaluations, given more positive ratings.

A second reason is that overall satisfaction measures are not sensitive to evaluations of specific components of a trip. For example, one's dissatisfaction with regulations might be compensated for by higher ratings of good weather. In addition, people have a tendency to engage in a rationalization process following participation in a trip (Shelby & Heberlein, 1986). For example, an experience might be evaluated slightly negatively at the time of its occurrence, however to justify expenditures of time money and effort, the person elevates their evaluation to reduce the dissonance in their decision.

Third, the effect of a prior year's satisfaction is typically not the only information about past experiences that are considered by the hunter. Last year's experience is considered in light of one's other prior experiences and knowledge. The marginal addition of information must be significant enough to outweigh other sources of information. Otherwise, the evaluation is conceptually the same as an evaluation of one's prior participation in the activity. This measure will give a positive association with future participation (i.e., past participation predicts future participation), but may not be a valid measure of that single season's effect.

In short, satisfaction with a given season's experience is not recommended as a measure of the effect of regulations on hunters. The relationships of primary interest would be between regulations and attitudes toward participation or, more directly, hunters attitude toward regulations.

Attitudes Toward Regulations

Certainly the most common type of human dimensions study is to ask hunters about their preferences toward management actions. Assessment of hunters attitudes are certainly the most direct and appropriate measures for attaining hunter input to regulatory decisions. Despite their frequent use, inaccurate assumptions about attitudinal measures toward regulations are frequent and can lead to erroneous conclusions. In particular, it would be

erroneous to assume that a negative attitude toward a particular form of regulation would result in declining participation. As noted above, a negative evaluation about regulations would affect attitudes toward participation only if it affected the beliefs considered important to the participation decision. For example, hunters may oppose a regulation because they feel it is unfair or because they oppose the agency or because they feel the regulation is too restrictive for the abundance of game. In each of these cases, they would still likely choose to participate in hunting. Further, it should not be assumed that a positive attitude toward regulations would result in participation in hunting. As we have seen in previous sections, a number of other factors enter that decision process.

Attitudinal studies in the human dimensions of wildlife area frequently do little more than assess hunters' evaluation of an alternative. However, more in-depth probes can answer the question why people hold the attitudes that they do which can be quite useful in exploring the possible effects that regulations have on participation decisions. This becomes clearer by revisiting the model of participation decisions (Figure 2). As was the case in the prior discussion of attitudes toward participation, attitude toward regulations is a function of outcomes associated with those regulations. There is a likelihood and desirability component attached to these outcomes. One's overall evaluation of the regulations will be a function of deliberation about all the outcomes associated with the regulations. For purposes of estimating the effect of regulations on participation, what is important is the extent to which these beliefs enter the decision about whether or not to participate in the coming season.

Long Term Participation

Since the mid-1950s, hunter participation has fluctuated considerably. While participation increased from the mid 1950s to the mid 1970s, it has decreased since that time and is projected to remain flat for the next two decades (Decker et al., 2001). Enck, Decker and Brown (2000) provide evidence that recruitment of hunters may be a problem as there has been a decline in participation by younger age categories and due to declines in hunter education graduates. Boxall, Watson and McFarlane (2001), based on an analysis of socio-economic correlates or trends, suggest the steady decline of hunter numbers in Alberta Canada is quite likely to continue. The ability to recruit and retain current hunters has serious implications regarding funding for fish and wildlife agencies. As a consequence, managers are vigilant of the effects they might have on long term hunter participation and are urged to consider programs that can reverse this trend.

The available research, however, suggests that factors affecting this trend are broad based and culturally derived (Bissell & Duda, 1993; Boxall et al., 2001; Enck et al., 2000; Heberlein & Thompson, 1991). Cultural shift theory advanced by Inglehart (1990) offers guidance in seeking explanation for the phenomenon of declining hunting participation. Inglehart (1990) suggests that values in post-industrialized society shift as the needs of the populace move from basic to higher order needs. He describes this as an inter-generational shift from materialistic (focused on economic well-being) to post-materialistic (quality of life, environmental protection, and self expression) values. He suggests that the shift toward these values is associated with increased affluence (and hence the absence of

concern over materialist needs). Manfredi, Teel and Bright (2003) suggested the broader societal trend revealed by Inglehart may be related to a trend toward “protection” wildlife values (which includes wildlife right beliefs) and away from “utilitarian” wildlife values (which includes pro-hunting beliefs). They also proposed, consistent with Inglehart’s findings, that the shift toward protection values is associated with income, urbanization, residential mobility and education. In other words, the theory suggests that broad social factors (affluence, urbanization) affect cultural values (increased protection values) and that these values affect observed hunting participation.

Using Inglehart’s measures of materialist and post materialist values and protection-utilitarian wildlife values measures, these researchers conducted research in six western states (Manfredi et al., 2003). Using state-level analyses they found a strong relationship between income, residential stability, urbanization, education and percent “traditionalists” (those with utilitarian wildlife value orientations and with materialistic values) in a state. Findings suggest these broad societal factors have an important impact on shaping the composition of values in a state. Figure 3 expands those findings by showing the relationship between the value composition within a state and the percent of active hunters (computed as the percent of people who hunted at least once in their life who also hunted in the past two years). The strong relationship displayed on the graph lends credibility to the notion that the broad cultural factors that are causing shift in cultural values are at the foundation of patterns found in long term hunting participation, recruitment and retention. This finding is supported by research by Zinn, Manfredi and Barro (2002) that examined within family, intergenerational value similarity. These researchers found that when father-son value shift occurred, it was associated with urbanization and residential mobility.

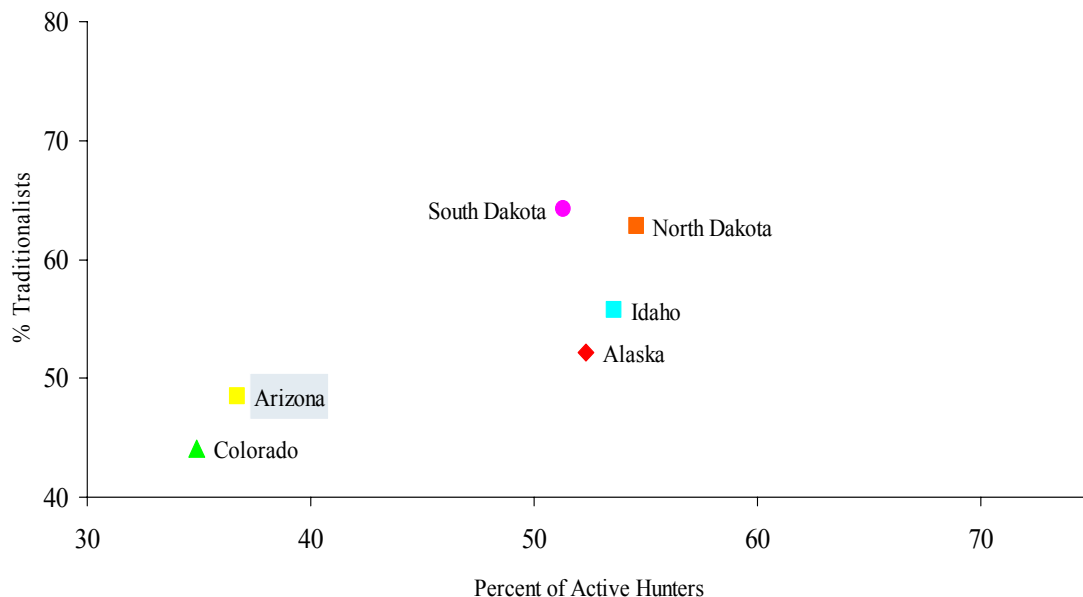


Figure 3. Percent of Traditionalists By Percent of Active Hunters For Six Western States¹

¹ Traditionalists are defined as those who are classified as Materialists using Inglehart's value scale and Utilitarians using the Protection-Use Wildlife Value Orientation scale. Percent active hunters was computed as the percent of those who ever hunted who also hunted in the past two years. Variables were correlated at $r=.814$, $p=.042$.

These findings suggest that broad cultural factors are driving cultural value shift and that hunting participation trends are the result of this change. In this context, it would be concluded that most hunting regulations do not address the influence of these cultural factors and will have little impact on the long-term trend of hunter participation.

Conclusion

Based on the review of literature provided here, the following conclusions are drawn:

- Regulatory restriction has an effect on short term hunting participation though the exact form of the relationship is unknown. Longitudinal research would help clarify that relationship.
- Effects of regulations on participation decisions should be examined in the context of a model of hunters' participation decisions. This model would conceptualize attitudes, perceived behavioral control and normative influences as predictors of participation behavior (See Figure 2).
- Regulations would affect the decision process through an assessment of hunters' attitudes toward regulations (and beliefs about outcomes associated with the regulations). Two factors are hypothesized to be strong predictors of the effect of regulations on behavior: effects of constraints/barriers and effects on beliefs about the improved/worse harvest conditions.
- Satisfaction with a season is affected by regulations, but the satisfaction concept is limited in its ability to help understand hunters' participatory decisions.
- Regulations have minimal effect on long-term hunter participation; effects may be limited to regulations that address those broad based cultural factors that drive trends in participation.

Chapter 3: The Relationship Between Waterfowl Hunting Regulations and Conservation Behaviors

Ben Peyton

One of the objectives of the Think Tank effort was to consider how regulations affect involvement in conservation programs. At a very specific and applied level, an example would be whether regulations served as barriers or incentives for private wetland owners to manage, retain or acquire wetlands. Impacts of specific regulations on such specific conservation behaviors could be a criterion in the regulation setting process. The literature has addressed factors that influence such behaviors as private landowner practices or regulation compliance among waterfowl hunters. A review of this literature might suggest relationships between regulations and categories of specific conservation behaviors. However, the Think Tank project did not attempt to review available literature pertaining to such a specific level of application

The focus of the Think Tank exercise was extended beyond these specific behavioral questions to consider some fundamental questions regarding the existence of a significant relationship between participation in waterfowl hunting and environmental stewardship. A special issue of *The Wildlife Society Bulletin* (Winter 2000; Vol. 28, #4) addressed many aspects of the partnership between wildlife management and those who hunt or trap wildlife. Several articles in the collection considered the question of environmental stewardship among hunters. Among them, Peyton (2000) argued strongly that development of environmental stewardship among the hunting community was the only benefit that produced a significant redeeming value of hunting for the non-hunting society. Holsman (2000) reviewed the rationale for the presumption that hunters form a base of concerned citizens (i.e., stewards) who support efforts to achieve broad-based conservation goals. He also suggested that Dixon, Seimer, and Knuth (1995) offered a more operational definition of stewardship than that posed by Aldo Leopold and recommended the following quote to guide wildlife management:

Stewardship is the moral obligation to care for the environment and the actions undertaken to provide that care. Stewardship implies the existence of an ethic of personal responsibility, an ethic of behavior based on reverence for the earth and a sense of obligation to future generations. To effectively care for the environment, individuals must use resources wisely and efficiently, in part by placing self-imposed limits on personal consumption and altering personal expectations, habits, and values. Appropriate use of natural resources within the stewardship ethic involves taking actions that respect the integrity of natural systems (Dixon et al., 1995, p. 42-43; *in Holsman 2000*).

A strong argument can be made that an expected outcome of providing and nurturing waterfowl hunting opportunities should be a waterfowl hunter community with a strong sense of stewardship for not only a sustained waterfowl harvest, but for the associated ecosystem as well. Holsman (2000) posed four needs that stewardship among hunters would address:

- Support for wildlife management program goals...to meet a balance of social values including optimal (rather than maximum) production of game species, a diversity of recreational opportunities, and control of nuisance wildlife species;
- Support and participation in broader ecological objectives [*related to*] conservation biology and the concern for loss of biodiversity;
- Participation in achieving population objectives related to enhancing social and/or ecological objectives...[such as]...aggressive harvest of nuisance populations of species like deer and geese; and
- Adopt lifestyles and behaviors, which serve to reduce the negative impacts of human beings on general environmental quality.

If we accept the argument that broad stewardship among hunters is important, the question of influence of hunting in general and regulations in particular on the development of associated attitudes, values, knowledge and behaviors must be addressed.

Holsman also asked whether the long acclaimed relationship between hunting and conservation support was really adequate and presented evidence that much needed to be done by the wildlife management profession and their hunting partners to make it so. There is no doubt that the hunting community collectively provides huge financial support and segments organize within the community to support conservation using political, educational and other strategies. Some of these campaigns have historically produced critically important conservation benefits. However, often conservation efforts of groups are narrowly targeted at their own specific resource interests and sometimes at the expense of broader ecosystem values. Professional wildlife managers are well aware that hunters do not always see the big picture and are often unwilling to compromise their interest in recreational benefits to cooperate with ecologically based goals. This phenomenon has also been documented in the literature (see Holsman, 2000). To the extent these hunter behaviors are the result of a failure to value stewardship ideals, this is especially problematic. However, it cannot be assumed that hunters opposing ecologically sound management are doing so out of poor stewardship.

The discussion in this report, which explains how the Reasoned Action and Planned Behavior Theory may be used to model factors influencing intentions and behaviors, is also applicable to this question of stewardship or conservation behaviors. Specific applications are not repeated here in the context of a different set of behaviors. Suffice it to say that conservation behaviors or lack thereof can be influenced by the same types of value and belief components. Hunters obviously vary in the values they place on such things as harvest and ecological attributes (e.g., biodiversity). A portion of hunters are harvest oriented, with high priority on utilitarian benefits and low priority on ecological impacts of management or hunting. At the other extreme are those for whom the waterfowl resource, its habitat and the associated biodiversity are more important than harvest. The utilitarian group is likely to express concerns for conservation measures upon which waterfowl resources are dependent, but their concern for broader ecological impacts is less certain. The reasons for this diversity of perspectives vary, but they certainly involve a complex of

values and knowledge held by hunters. For example, a southern Michigan investigation of stakeholders attitudes about ecosystem management on state game areas revealed that hunter segments (waterfowl hunters, deer hunters) and non-hunting segments (Sierra Club and Audubon Society members who did not hunt) shared a surprisingly common value for biodiversity. They differed primarily in the extent to which they believed biodiversity was inadequate on the area. Hunters valued biodiversity, but believed it needed no improvement and therefore ecosystem management strategies that compromised recreational benefits were not acceptable (Holsman & Peyton, 2003).

In summary, there is sufficient evidence to show that the assumed influence of hunting participation on hunter stewardship ethics is not universal among hunters and/or is not universally expressed in all issues. Hunting may contribute to the development of stewardship ethics and behaviors among the hunting community but it does not appear to guarantee that development nor is it the only means of influencing such development. This presents a rich and critical area for future research.

Nestled within this issue of stewardship as a natural outcome of hunting participation is the central question of whether regulations influence the development of stewardship in individuals or the community at large. Can regulations be crafted to encourage hunters who are more knowledgeable and place a high value on the integrity of the ecosystem (beyond its capacity to produce a harvestable surplus of waterfowl)? Conversely, are regulations sometimes barriers to achieving these perspectives among hunters? There is no evidence to show how the current goal of the AHM process (maintain the maximum allowable harvest) influences this desired outcome among waterfowl hunters but some hypothetical relationships could be posed.

For example, stewardship might be impacted through the dynamics of recruitment/regulation relationships. Some evidence exists to suggest that liberal harvest limits and regulations over a period of time may result in a qualitative shift towards more utilitarian hunters in the make-up of the waterfowl hunting community. If so, we could expect substantial hunter demands for maximum allowable harvests even if associated risks to species or ecological communities emerge. Waterfowl management goals to maintain ecological integrity would increasingly conflict with goals to maintain hunter participation, funding and harmony.

Although stewardship attitudes and knowledge cannot be regulated, the perspectives held by waterfowl hunters may be hypothetically reinforced either appropriately or inappropriately by regulations and regulation-setting processes. Regulations that vary considerably from one year to the next may be perceived by hunters as derived from a decision process that is disconnected from ecological parameters. Even hunters who have a strong stewardship ethic may adopt inappropriate behaviors if they do not believe the regulations reflect good stewardship; i.e., if the process and rationale have not been adequately communicated. The current AHM process utilizes a model built on mallard populations and assumes other species are adequately protected by corresponding regulation choices. To the extent this fails to protect species or presents a misleading message to hunters, it jeopardizes their understanding of the management process and its

obligation to be ecologically responsible. Whether or not the relationships implied here are the subject of future research, certainly the impact of the state of the regulation setting process on hunter perceptions of a holistic, ecosystem management approach should be one criterion of decision making that receives some deliberation in evaluating the AHM process.

Chapter 4: Research Needs and Approaches

Jody Enck and Mike Manfredo

Previous chapters discussed different kinds of satisfaction that are associated with waterfowl hunting broadly, and with regulations within AHM more specifically. Those chapters also described how year-to-year participation in waterfowl hunting (i.e., recruitment and retention) and within-year participation (i.e., which both can affect satisfaction and is affected by satisfaction) are dynamic processes influenced by many factors, including but not limited to, regulations established as part of AHM. Information about the different kinds of satisfaction and the influences of AHM on the dynamics of participation is needed to improve management decisions at the state, federal, and Flyway levels. Here we describe some possible approaches for measuring and monitoring participation, especially in terms of hunter recruitment and retention, as well as the different various kinds of hunter satisfaction.

Hunter Recruitment and Retention

Although waterfowl hunter recruitment and retention likely are affected by many factors outside the context of AHM, managers need to examine possible influences of AHM on the dynamics of participation because of the uncertainty about whether more restrictive regulations (in particular) diminish harvest or harvest opportunities enough to dissatisfy hunters and reduce the number of active hunters. The number of active hunters in any given year is assumed to be related to financial support for waterfowl management and conservation (e.g., revenues from “duck stamp” sales), participation in waterfowl stewardship activities (i.e., through individuals or groups like Ducks Unlimited), and achievement of state agency goals to provide satisfying wildlife-related recreation within ecologically sound limits.

Important management questions to address through research include influences of changes in (a) federal guidelines for bag limit and season length, and (b) state-specific implementation of season openings, split seasons, and other opportunity trade-offs on (c) numbers of different types of hunters (e.g., potential, active, inactive). A panel study approach, which tracks the same individuals over time, would provide the greatest insight about relationships among the factors listed above.

To select panel members, a random sample of the general public, stratified to provide regional representation (e.g., between Flyways, or north-south within a Flyway, depending on desire levels of precision and degree of similarity in states’ selection of management alternatives within the federal guidelines), could be surveyed by telephone to categorize respondents as: (1) potential waterfowl hunters (never hunted waterfowl previously but might do so in future), (2) currently active hunters (hunted in previous year and intend to hunt next year), (3) currently inactive waterfowl hunters (hunted some time in the past but not in most recent year and intend to hunt in future), (4) permanently inactive waterfowl hunters (hunted in past but do not intend to hunt in future), and (5) not waterfowl hunters (no previous waterfowl hunting experience and no intention to hunt waterfowl in the future). These persons would be considered representative of the total, dynamic population

of waterfowl hunters, and could be incorporated into the existing Harvest Information Program (HIP) database. Movement of individuals between categories could be tracked through a modified HIP survey in response to changes in federal guidelines or state-specific alternatives within AHM.

An advantage of this approach is the ability to correlate changes in numbers of active and inactive waterfowl hunters with changes federal and state waterfowl harvest regulations. Two disadvantages of the approach described are (1) the inability to identify factors other than AHM regulations as potential causes of changes in hunter participation dynamics, and (2) insights about the effects of regulations on hunter recruitment limited to movement from potential to active categories. Further, this approach sheds little if any light on other important outcomes assumed from recruitment and retention, namely “duck stamp” sales and participation in conservation stewardship behaviors.

However, by extending the use of the panel to assess factors outside of the AHM decision-making process, additional insights could be gained about the degree of influence AHM has on participation dynamics compared to other influences. For example, questions could be asked of panel members by modifying the HIP survey to assess disparities between individuals’ expectations for seeing ducks (e.g., based on information provided by state agencies or the USFWS) and individuals’ perceptions of the fall flight, or any changes in social support for waterfowl hunting, hunting access, waterfowl hunting companions, etc. Further, questions could be asked of panel members to determine the influence of different kinds of satisfaction on the dynamics of waterfowl hunting participation.

Hunter Satisfaction

Different approaches likely are needed to measure the different kinds of satisfaction described in Chapter 1. State waterfowl managers likely would benefit most by monitoring hunters’ evaluation of overall satisfaction and the various factors contributing to their satisfaction or dissatisfaction because providing satisfying experiences for hunters is a goal at the state rather than federal level. Both state and federal managers likely would benefit by monitoring hunters’ satisfaction with waterfowl hunting regulations (i.e., framework packages at the federal level, and specific options implemented at the state level). Finally, state and federal managers likely would benefit from research directed at identifying and understanding the fundamental ends hunters associate with harvest, so satisfying (i.e., desirable/tolerable) levels can be managed to the greatest degree possible through AHM.

Overall satisfaction

Many states already survey license buyers, either by mail or telephone, to estimate harvest of various species, days of participation, and other related information. Some states undoubtedly assess hunters’ overall satisfaction with their hunting experiences, based on species hunted (e.g., waterfowl, big game, etc.). A relatively simple approach for coordinating this effort among states would be to incorporate one or more questions about overall waterfowl hunting satisfaction into the HIP survey as described above in the section on participation. Overall satisfaction tends not to change quickly or very dramatically from

year to year in response to regulatory changes, unless radical changes are made in regulations. Therefore, a periodic assessment (e.g., every 3-4 years) may suffice, rather than an annual assessment.

Advantages of this approach include: (1) the same question(s) could be assessed for all states and Flyways, (2) changes in overall satisfaction potentially could be linked to changes in regulations or hunting opportunity, and (3) changes in satisfaction could be linked to other data collected through the HIP survey, including harvest and effort data. Further, if changes were made to the HIP survey to involve a panel study of individuals, possible relationships could be explored between overall satisfaction and hunter population dynamics.

Disadvantages of this approach include: (1) inability to identify and weight factors (i.e., satisfaction or dissatisfaction components) other than regulatory packages, amount of legal harvest opportunity, and actual harvest and effort on overall satisfaction, (2) lack of insight about potential relationships between hunters' satisfaction with Flyway-wide regulatory packages or state-level actions and overall satisfaction.

Satisfaction with regulations

Satisfaction with, or preferences for, regulatory packages (or preferences for trade-offs within or between packages) likely should be assessed at the level of Flyways or individual states. Telephone surveys generally can be completed more quickly than mail surveys, but are more limited in terms of trade-offs that can be assessed because of the increased difficulty in providing explanatory material on the phone versus in writing. Greatest understanding could be generated by surveying potential, active, and inactive waterfowl hunters, although identifying this broad pool of individuals is difficult without some kind of a panel study as described above.

Advantages of this approach include: (1) ability to assess the percent of hunters who would be satisfied or dissatisfied with various regulatory trade-offs, and (2) increased ability to anticipate levels of complaints or need for "issue management" that may be associated with different management options.

Disadvantages of this approach include: (1) lack of insight about whether a high level of satisfaction with a regulation means that hunters would take advantage of opportunities provided through it (or if high dissatisfaction would mean less participation in the opportunity), and (2) focus on perceptions of active hunters because those are the easiest to identify and survey.

Satisfaction related to the fundamental ends that hunters associate with waterfowl harvest

A basic assumption of AHM is that maximum sustained harvest over time will lead to highly satisfied hunters who will continue waterfowl hunting over time. However, harvest regulations and incentives controlled by either federal or state wildlife agencies do not

manage harvest per se, but instead manage the opportunity for hunters to harvest waterfowl if they want to do so. The distinction may seem subtle, but the difference is fundamentally large. Waterfowl harvest is not the main motivational goal for most hunters. Although more restrictive regulations place a ceiling on legal harvest levels, selection of more liberal regulations does not ensure that hunters will avail themselves of the increased harvest opportunity. For waterfowl hunters, harvest is a volitional (i.e., free choice) behavior influenced by various factors. Typical harvest regulations do not manage this behavior, but rather manage the opportunity for hunters to exhibit the behavior “if they voluntarily choose to do so.” This has implications for AHM.

Social science theory can help identify factors (including, but not limited to, harvest regulations, satisfaction with regulations, and overall satisfaction) that influence harvest. For example, the Theory of Planned Behavior is a useful foundation for increasing managers’ understanding about these relationships. Theoretically, a specific behavior (e.g., harvesting waterfowl) can be predicted by one’s intention to carry out the behavior. In turn, the intention to harvest is affected by their attitude toward the behavior, perhaps moderated by personal importance of harvesting waterfowl. Attitude toward harvesting waterfowl could be influenced by a variety of factors including: one’s perception of the consequences of harvesting waterfowl and objective knowledge about waterfowl status (i.e., cognitive factors), one’s emotional response to harvesting waterfowl (i.e., affective factors), and attitude towards waterfowl (i.e., the target of the behavior). Of these various factors, hunting regulations and incentives that affect opportunity to harvest waterfowl most directly relate to cognitive factors.

Consequences of harvesting waterfowl could be evaluated by a hunter as either good or bad depending on a hunter’s motivations. An achievement-oriented hunter interested in filling a bag limit or harvesting waterfowl with some kind of trophy value might interpret harvest positively. Someone interested in solitude and connecting with nature could evaluate harvest as more of a cost than a benefit. Even achievement-oriented hunters who want to take waterfowl with a particular trophy value may be disappointed by shooting the wrong kind of duck.

Further, hunters who indicate that they have a positive attitude toward harvest and intend to harvest waterfowl may have very different reasons for wanting to harvest waterfowl. If research identifies more than one reason why hunters want to harvest waterfowl (e.g., to eat, to achieve status, etc.), then harvest, itself, is not a fundamental end of waterfowl hunting. In this case, harvest would be only a *means* for achieving other *ends*. Theoretically speaking, the same should be true in terms of why hunters may want to harvest waterfowl in a particular way. Shooting birds over decoys could be desirable because it takes skill to call-in and decoy birds, or because it allows a greater chance to identify sex or species of birds so the hunter can conserve (i.e., not shoot) species with low population sizes, or because it decreases the chances of crippling and wasting birds.

Identifying and understanding these reasons why hunters want to harvest waterfowl, harvest waterfowl in a particular way, or want not to harvest certain waterfowl (e.g., hens) or in certain ways (e.g., pass-shooting vs. over decoys) is essential for understanding hunter

satisfaction. If a goal of state waterfowl managers, in particular, is to provide satisfying experiences for waterfowl hunters, it is essential for managers to understand how hunters think about “mission accomplishment.” In other words, how do hunters think about success of management in terms of hunting satisfaction. Quite likely, high populations of waterfowl and a great amount of opportunity to harvest waterfowl are important in terms of hunters believing that waterfowl management is a success. However, these evaluations of management success can be tempered tremendously by whether hunters experience desirable/acceptable levels of the fundamental ends they associate with waterfowl hunting, and particularly harvest in the context of AHM.

Unfortunately, there is little prior experience that would give guidance to developing metrics that reflect the fundamental ends hunters associate with harvest or other aspects of waterfowl hunting. Therefore, it would be necessary to conduct formative research to determine the measures that would be most appropriate for this situation. Accordingly, we would propose a two-staged study. In the first stage, a group interview technique (either nominal or focus) almost certainly is needed to elicit fundamental, harvest-related ends of importance to hunters and to articulate the “currency” – or ways of describing these ends — that is meaningful to them. Further, insights are needed about the dynamic system of factors that influence the levels of these fundamental ends (i.e., cause them to increase or decrease). Greatest benefit probably will result if group interviews are stratified by Flyway and north-south within Flyways.

A second stage of research would involve quantitative verification of important fundamental ends identified in the first stage. This could be accomplished conceivably by modifying the existing HIP mail-back questionnaire. Further, the surveys could be used to parameterize fundamental ends by asking hunters to assess current levels, and minimum levels they desire (for positive ends) or maximum levels they would tolerate (for negative ends) levels. For example, hunters generally like to harvest ducks, but how much harvest do they need to be satisfied? In other words, what minimum level of harvest sufficiency do hunters need to experience before they call waterfowl management a success? Further, high bag limits could be interpreted negatively if hunters think some hunters will take an excessive number of ducks. What level of excessiveness are they willing to tolerate and still say management is a success?

Target levels for these harvest-related impacts (and that are conceptually linked to hunter satisfaction) could be incorporated into revised AHM models as objective functions. Using input from stage one of the research, a model could be created of the system of factors thought to influence the level of the objective functions – much like the decision models used now by federal managers developing regulatory packages within AHM. This system of factors, by necessity, will include ecological components and processes, although those may not be the predominant elements in the model. By examining the relationships among factors in the model and exploring how changes in those relationships affect the behavior of the variables in the objective functions, managers can identify alternative sets of management actions or policies—in addition to current AHM regulatory considerations.

Advantages of this approach would include:

1. Objective functions meaningful to hunters and related to hunter satisfaction can be identified and incorporated into existing AHM models.
2. Management actions that should have the greatest likelihood (i.e., hypothesized influence) on achievement of desired/tolerable levels of harvest-related impacts (and hence hunter satisfaction) can be identified and implemented experimentally.
3. Taken together, #1 and #2 should reduce uncertainty about partial controllability – the lack of control over harvest and hunter satisfaction associated with changes in regulations.
4. This approach should identify data collection needs and focus research attention on parameterizing and monitoring variables of greatest importance for understanding the system models developed through AHM, and examining hypotheses about how that system will respond to management actions.
5. By first identifying fundamental ends related to hunter satisfaction, developing a model based on factors that influence levels of those ends, and experimenting with management alternatives developed from that model, uncertainty about the appropriate structure of AHM models should be reduced greatly.

Disadvantages of this approach include the necessity to make trade-offs about generalizability of the models in the context of AHM, and geographic specificity needed for Flyways or north-south groupings of states to make implementation decisions within federal guidelines. Another disadvantage is the challenges of identifying harvest-related fundamental ends of any type, but especially negative ends that currently are above tolerable levels for hunters and that might be managed at more acceptable levels through AHM. Finally, describing fundamental ends in a currency that is meaningful across geographic scales and then parameterizing current and objective levels of those ends will be methodologically and conceptually difficult.

Chapter 5: Implications for AHM

Shorna Broussard, Ben Peyton, and Jody Enck

Waterfowl scientists engaged in adaptive harvest management of waterfowl have gained much knowledge about the waterfowl management system since the early 1990s. The implementation of experimental management actions to investigate hypotheses about the structure of that system and how it works has been one of the best planned and documented applications of adaptive management of a natural resource. That is not to say that great gaps in knowledge no longer exist. Indeed, one of the most difficult challenges is the high level of uncertainty associated with attempts to predict harvest (and harvest rates) based on changes in harvest regulations.

As noted in Chapter 4, AHM is an attempt to achieve predictable harvests (and harvest rates) of various waterfowl species to provide biologically-sound harvest opportunity and sustain hunter interest and participation while at the same time conserving waterfowl populations. However, development of predictive models with levels of precision and accuracy desired by waterfowl scientists remains elusive.

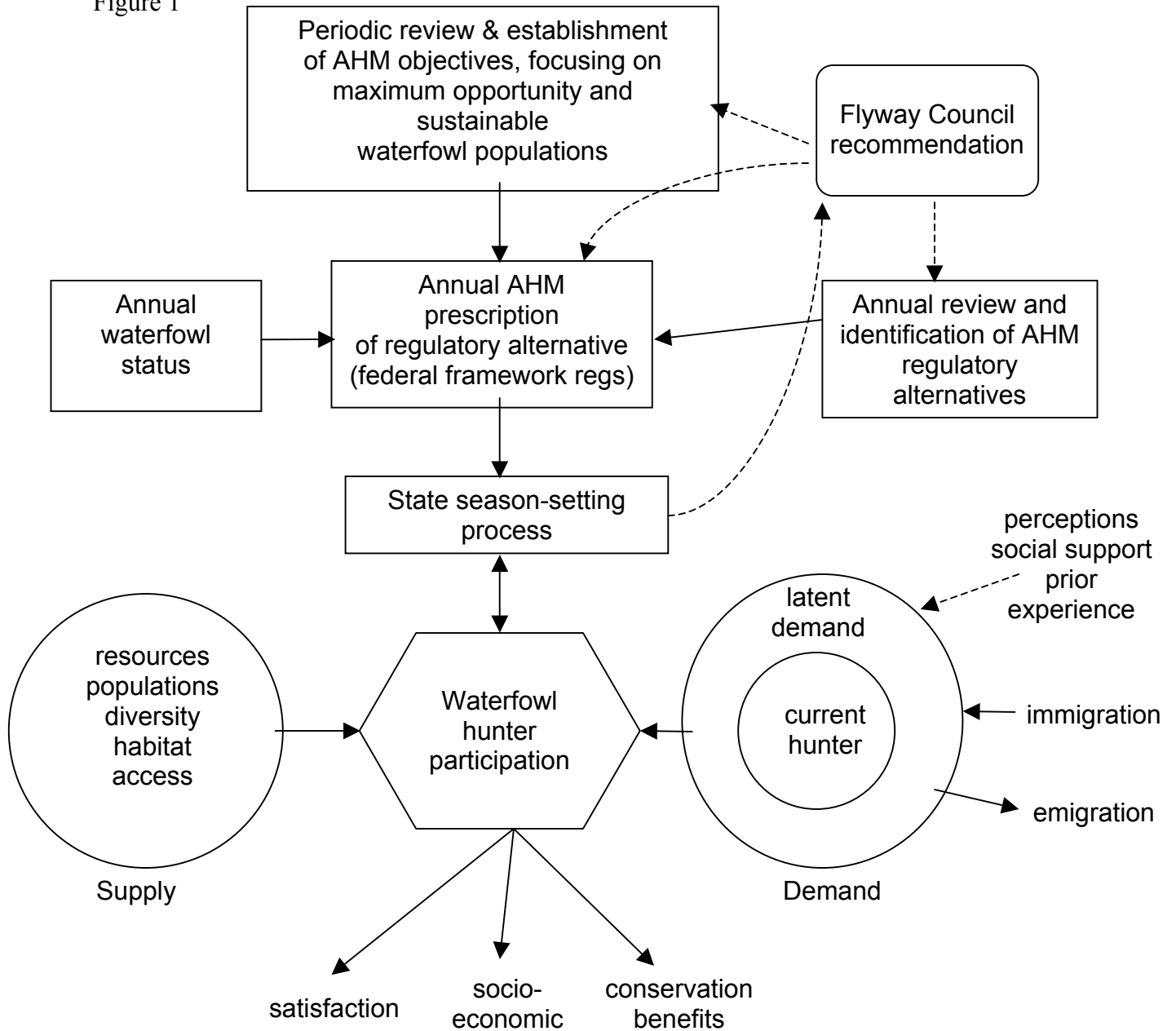
The challenge lies in maintaining the balance between scientific rigor and credibility while ensuring that management practices respond to a diverse and dynamic set of stakeholders. Crafting regulations to meet these criteria is made more difficult by the complexity of the regulation process at federal and state levels. The question of accommodating hunter attitudes and biological waterfowl goals is being posed at the federal level in this project, but solutions may be more effective at state levels of decision-making. Figure 1 suggests the relationship among the three levels of management, impacts on hunters and associated benefits assumed to result from hunter participation.

Federal Level

At the federal level, the primary responsibility of waterfowl management is to ensure sustained, ecologically viable populations of waterfowl species. To the extent possible, this is to be accomplished while making adequate harvestable surpluses available for hunting to sustain recruitment and retention of waterfowl hunters. Regulations contribute to these goals by controlling recreational harvest. Regulations also allocate harvest opportunity to flyways, states and hunter groups.

In its authority to manage migratory waterfowl, the USFWS has developed AHM to predict allowable harvests that would achieve waterfowl population goals. Each year, to restrict national harvest to desired levels, the AHM system selects one of the prepackaged regulatory alternatives as a regulation "sideboard" for states (maximum season length, restrictions on season opening and closing, bag limits). In essence, the USFWS estimates the allowable harvest and allocates this surplus to states by establishing broad harvest-related regulations.

Figure 1



A focus at the federal level has been implementation of alternative management actions (i.e., different waterfowl regulation packages) to examine hypotheses about ecological relationships in the model (e.g., density dependence vs. predator-prey oscillations; additive vs. compensatory harvest mortality). The range of possible processes is relatively limited although feedback among them may be complex (Hannon & Ruth, 1997). Experimental efforts to learn which hypothesis precisely predicts a response in the objective function are constrained by the types of actions under the control of wildlife managers. As noted in Chapter 3, many important factors affecting hunter satisfaction fall outside the frame of regulatory actions on which managers typically focus.

Under a scenario where stakeholder input is used to identify “new” objective functions at the federal level as part of AHM (see Chapter 4), model conceptualization would begin with stakeholder-defined fundamental ends that are the objective function(s) to be managed (Riley et al., 2003). Factors affecting those ends also would be identified, and their dynamic interactions modeled. Understanding of this revised model of the waterfowl management system, raises both the possibility of identifying innovative management actions on the part of federal waterfowl managers. Indeed, identification of an optimal set of management actions probably is not possible until a conception of the management system is developed based on identification of appropriate objective functions that are the focus of waterfowl management.

The adaptive part of adaptive management refers not only “...to managers learning about systems as the attempt to manage them” (Lancia et al., 1996:439), but also to the adaptation of management actions to address management problems. This undoubtedly goes beyond selecting more liberal or more restrictive regulations for harvest management or choosing among habitat improvement or predator removal to increase the population of certain species. Being adaptive may require finding ways to facilitate implementation of actions under the purview of other agencies or having stakeholders take on responsibilities that agencies simply cannot take on (e.g., landowners increase access). Developing hypotheses about the kinds of truly innovative actions needed to achieve objectives based on stakeholder-valued impacts should help overcome perceived threats to management programs and lines of research by demonstrating the usefulness, if not need, to be adaptive.

Flyway Level

With this set of guidelines, states meet in Flyway Councils to work out agreements and season approaches. Some self-imposed restrictions may be mutually agreed to at this flyway council. However, the real implementation of regulations is at the state level. The states must design their own regulations to be no less restrictive than the Federal guidelines as they determine the details of their own seasons. For most regulatory alternatives, states have many options in that seasons can be split, opening dates can be manipulated within the federally prescribed limits, etc.

State Level

It is at the state level that hunter attitudes are most effectively impacted by regulations. The success of that effort depends on at least two conditions. One is that the annual federal sideboards be "in the ballpark" and provide sufficient flexibility for states to address hunter preferences. The other is that state decision makers are adequately informed as to what the hunter preferences are and how those are impacted by regulation options. Both will require a clarification of the intended outcomes and an improved understanding of relationships between regulations and hunter preferences.

The AHM approach was built in part on the assumption that maximizing harvest will generate hunter satisfaction and thus achieve all desired human dimensions goals. That assumption is incorrect for several reasons, but it may not follow that the AHM premise to identify allowable harvest limits and allocate them to the states is a poor one. Given that the regulatory alternatives are appropriate, the state decision-makers are in the best situation to nurture -- or inflame -- hunter attitudes. The rationale for this position is too broad to detail here, but it relates to such factors as the diversity in hunter characteristics (e.g., satisfaction dynamics) within states and across flyways. It is not likely that efforts at the federal level alone would be able to provide the desired outcomes in national hunter satisfaction.

Accommodating both biological goals and social goals in waterfowl regulation setting will require a systematic approach that addresses a wide range of components. Certainly a key need is to understand and incorporate the dynamics of hunter participation (e.g., satisfaction, recruitment, retention, compliance, etc.) and how they relate to regulatory options. But equally important elements appear to have been overlooked. For example, the whole realm of public involvement in the process, most importantly at the state level, will impact on intended successes. People and political processes are central features of adaptive approaches to management and adaptive management requires active participation by those most affected by the policies, in this case waterfowl hunters (Shindler & Cheek, 1999). Shindler and Cheek outlined six areas where agency-citizen interactions are most effective. The tenets of success lie in open and inclusive processes built on skilled leadership, flexible and innovative methods, early and continuous citizen involvement, and trust-building among participants. States use a diversity of models for involving stakeholders in the decision making process and these need to be documented and evaluated to determine how the processes could be made more effective in achieving national goals.

For the purposes of illustration, consider the Michigan regulation setting process, which uses an advisory council (Citizens Waterfowl Advisory Council -- CWAC) to get input on regulation options each year. A survey of a large statewide sample of waterfowl hunters and CWAC members showed substantial differences in preferences between the two groups and yet CWAC greatly influence the final selection of regulations. In most instances, the selection of regulatory alternative has far less impact on the satisfaction of this diverse Michigan hunter community than the final permutation of regulations by the state. Questions need to be answered regarding the reliability of information from the

highly specialized hunter segment represented by CWAC members. Their input could actually be a valid assessment even though survey results differ, because they are more experienced and informed and better able to evaluate choices of season opening dates, etc. Alternatively, their own preferences may not satisfy the statewide population at all suggesting the public input system is not representative and likely to continue to fail to optimize hunter satisfaction with waterfowl regulations.

At All Levels

Incorporation of human dimensions insights can help managers re-think the general structure of the waterfowl management system by eliminating confusion about the different kinds of satisfaction (e.g., with regulations, with experiences, overall) and how they probably influence hunter behavior. This could be particularly beneficial given that federal, Flyway, or state decision makers may be interested in or concerned about different types of satisfaction.

Understanding which kind of satisfaction managers are concerned about, and the various management outcomes (e.g., harvest opportunity) and decision-making procedures (e.g., use of models at the federal level or use of task forces to solicit input at the state level) that affect satisfaction should go a long way to reduce uncertainty in decision making at all levels. A key characteristic of adaptive management is explicit recognition of uncertainty about the management system (Walters, 1986; Lancia et al., 1993; Williams, 1997). Four kinds of uncertainty affect outcomes of adaptive management and the interpretation of those outcomes. One kind of uncertainty is *environmental variation*, which differentially influences ecological processes and human behavior from year to year (e.g., in dry years vs. in wet years). Another is *partial observability*, which refers to sampling error in observing the state of the system at the time of the management decision (i.e., quantities that are both dynamic and unknown). A third is *partial controllability*, which is a lack of predictability between management actions and an expected change in the objective functions. The fourth is *structural uncertainty*, which is associated with limited understanding of and conceptualization of the management system. By designing management actions to test (i.e., verify or refute) hypotheses about how best to achieve management objectives, the different kinds of uncertainty can be reduced (Walters, 1986). Incorporation of ecological and human dimensions at all levels of decision making could be expected to reduce these uncertainties in ways presented in Table 1.

Table 1. Types of uncertainty affecting decision making, and implications of and possible solutions for each type.	Current implementation of AHM	Re-conceptualized implementation of AHM described in this chapter.
Environmental uncertainty	Affects resource status and ecological processes that influence resource status.	Affects stakeholders' perceptions and behaviors. At most, has an indirect

	Thus, has a direct influence on objective functions. [e.g., fewer ducks in dry years because reduced survival of ducklings and higher predation]	influence on objective functions based on wildlife-related impacts. [e.g., hunters perceive a lower duck population during a blue-bird fall, regardless of actual duck population]
Possible solutions for addressing environmental uncertainty	Fix the model by incorporating a stochastic component that randomly influences mortality and survival annually. Or, examine hypotheses about things like whether duck population status is density dependent in dry vs. wet years.	Don't fix the model. Rather, experiment with alternative management actions to reduce the influence of environmental variation on stakeholder perceptions and behaviors that may be linked to impacts. [e.g., get hunters involved in collecting spring and summer duck data so their attitudes are not influenced so much by experiences during a couple of days during the fall]
Partial controllability	Affects how managers think about management alternatives. If management actions do not predict outcomes well, conservative actions are called for to reduce concern about over-harvest or other mortality factors for duck populations of smaller sizes. For overabundant species, lack of congruence between actions and outcomes means the problems will be worse next year.	Affects how managers think about the system being managed. If actions do not predict outcomes well, new components or feedback mechanisms need to be considered.
Possible solutions for addressing uncertainty associated with partial controllability	Measure variables in objective functions more precisely (e.g., better measure harvest, harvest rate, and population size). Hold management actions as constant as possible for several years. Also, determine stakeholder satisfaction with	Fix the model by re-conceptualizing the factors affecting levels of impacts in objective functions, and the feedback relationships among those factors.

	management alternatives and implement the one(s) that stakeholders are most likely to support.	
Partial observability)	Imprecise measures of objective functions like harvest rate and subsequent population size diminish model performance. Measuring wildlife populations, characteristics or populations, and ecological processes is difficult.	Imprecise measures of objective functions tied to impacts diminish model performance. But it may be easier to measure levels of impacts that stakeholders desire (e.g., through surveys or other established techniques) than ecological characteristics or process rates.
Possible solutions for addressing uncertainty associated with partial observability.	Identify and reduce measurement bias, response bias (for HIP surveys), and other forms of measurement error.	Use social science theory and techniques to identify and measure impacts of importance to stakeholders and to determine how ecological and social factors affect the impacts.
Structural uncertainty	Lack of understanding about which ecological processes (e.g., additive vs. compensatory mortality; density dependence vs. predation) drive the ecological-based management system necessitates experiments directed at improving that understanding.	Related to partial controllability. Incorporate HD objective functions into the model. Lack of understanding about factors that influence the impacts that stakeholders want managed necessitates re-conception of the model prior to experimentation.
Possible solutions for addressing structural uncertainty.	Develop alternative models based on competing hypotheses about which ecological processes have the most influence on objective functions. Implement an alternative management action for each alternative model.	Develop alternative models based on competing hypotheses about factors affecting impacts. Fix the model before selecting alternative management actions that can be tested on <u>one</u> model that should be expected to have low structural uncertainty (although that still could be examined empirically).

Conclusions

As demonstrated in the preceding chapters, it is challenging to make generalizations about the relationships between regulations, satisfaction, participation and involvement in conservation. The following conclusions and recommendations are based on the literature, and on the discussions within the Think Tank. These are not comprehensive, but represent the issues and suggested courses of action that the Think Tank believed would be most useful for managers.

1. Research suggests that regulations can have an effect on satisfaction and short-term hunting participation when there are dramatic changes such as a major reduction in opportunity or increased costs. However, it is difficult to predict accurately either the specific regulatory conditions affecting participation or the magnitude of the effect(s). Moderate changes in such things as season length or bag limits have not been shown to produce significant effects on recruitment and retention. Regulations may introduce new constraints to low-commitment hunters serving as the impetus for the gradual withdrawal from the sport.
2. The “preferences” of hunters for regulation options are dynamic and may:
 - Change over time;
 - Be influenced by expectations or perceptions about the resource condition; and/or
 - Be different for different subgroups of hunters (based on location, specialization, stage of development as a hunter, etc.) For example, specialists may prefer restrictive regulations so they can "capture" a larger share of the resource or hunting opportunity.
3. Satisfaction with a season may be affected to some extent by regulations, but satisfaction is only one of many considerations in hunters’ participatory decisions. Thus, participation (retention and recruitment) over the long-term is likely to be influenced to a relatively small degree by regulations. Rather, long-term participation is primarily influenced by broad-based changes in an individuals’ social and cultural values, many of which are beyond the natural resource manager’s control
4. Use of behaviors such as participation or license buying as an indicator of retention can be challenging for a number of reasons. First, not all “active” hunters participate in waterfowl hunting every year. Recent research indicates that there is a much larger pool of “active” hunters than previously suspected. In any given year, only a portion of this pool of hunters may actually hunt. As a result, the composition of hunters in any given year may be very different from the previous year. Beyond that, however, it is likely that a large percentage of hunters who eventually desert the sport do not make a conscious decision to quit. Termination is often marked by prolonged inactivity with the intention of one day returning to the sport.
5. Without more systematically gathered and appropriate information to guide regulatory

decisions, changes to regulations (or other management actions) may not have the intended consequences in terms of waterfowl hunter satisfaction, participation or involvement in conservation. Moreover, we don't have the information (particularly at the national level) to predict with reliability what the consequences might be and no monitoring tools in place that would allow us to discern changes after the fact. Although some human dimensions information can be gathered quickly, relatively inexpensively, and put to use immediately, there are needs that likely can only be met through long- term efforts requiring significant financial commitments and coordination from the waterfowl-management community.

6. The waterfowl-management community remains interested in framing objectives for the AHM process that relate more directly to hunter satisfaction and participation rather than to the size of the harvest. We continue to see no theoretical problem in pursuing objectives defined in these terms, but clearly there are major challenges in application. Considerable foundational research would be needed to identify the appropriate hunter-related performance metrics, how those parameters would be measured, and how they might be influenced by changes in hunting regulations. Given these difficulties, it may be more appropriate to pursue hunter-related objectives indirectly through the specification of regulatory alternatives and possible constraints on their use. Moreover, the most productive nexus for addressing hunter satisfaction and participation issues in the regulatory process may be at the State level, rather than at the federal domain of the AHM process.
7. If increased participation (recruitment and retention) of hunters over both the short and long term is important to waterfowl managers, then they must look at a broad array of factors that affect participation rather than regulations exclusively.
8. States use a diversity of methods for involving stakeholders in the decision-making process and these methods need to be documented and evaluated to determine how the processes could be made more effective. There is reason to question the reliability of input provided by highly specialized and involved hunters that participate through advisory committees and other processes, and how accurately it represents the hunters of a state or region. Their input may actually be a valid assessment even though survey results differ, because they are more experienced and informed and better able to evaluate choices of season opening dates, etc. Alternatively, their own preferences may not satisfy the statewide population at all, in which case the public input system is not representative and likely to continue to fail to optimize hunter satisfaction with waterfowl regulations.
9. There is evidence demonstrating that the influence of hunting participation on hunter stewardship and ethics is not universal among hunters and/or is not universally expressed in all issues. Hunting may contribute to the development of stewardship and related behaviors among the hunting community, but it does not appear to guarantee that development nor is it the only means of influencing such development. There is a growing recognition among waterfowl managers that human-dimensions information may be just as important to developing successful hunting regulations

and other management programs as is biological information. However, incorporating social information into management processes in a rigorous, scientific fashion represents a formidable challenge. There are three key reasons for this:

- a) The complexity of the relationships between hunting regulations and the outcomes managers seek, as well as a lack of consensus among managers about preferred outcomes and their priorities;
- b) A limited understanding of human-dimensions science among waterfowl managers; and
- c) Limited funding for monitoring and research of human-dimension issues of interest.

Given these **hurdles**, we believe the waterfowl-management community must engage in a more systematic discussion of human-dimension needs and their priorities relative to other management activities. This report serves as a foundation for that discussion.

Recommended Actions

As previously explained, the relationship between regulations, satisfaction, participation and involvement in conservation is very complex. Considerable effort by waterfowl managers will be required to understand and incorporate this relationship in future regulations.

Foundational research is needed to identify the appropriate hunter-related performance metrics, how those parameters would be measured, and how they might be influenced by changes in hunting regulations. In addition, monitoring tools need to be developed and implemented that would allow us to discern changes after the fact. Most of these needs can only be met through long- term efforts requiring significant financial commitments and coordination from the waterfowl-management community.

The most productive level for addressing hunter satisfaction and participation issues in the regulatory process will likely be at the State level, rather than at the federal domain of the AHM process. However, to obtain a full picture of the complex interacting factors, research and monitoring will be required at both levels. This will require waterfowl managers to look at a broad array of factors that affect participation and become much more familiar with human dimensions, rather than exclusively understanding the regulations process.

In addition, an evaluation of the public input process for developing regulations at both the federal and state level is needed to ascertain the reliability of input provided by highly specialized and involved hunters that participate through advisory committees and other processes, and how accurately it represents the hunters of a state or region in optimizing hunter satisfaction with waterfowl regulations.

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